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(54) Irrigation sprinkler with an internal drive clutch.

(57) A drive clutch mechanism for a pop-up oscillating irrigation sprinkler which serves to protect the internal components of the sprinkler against forceable rotation of the pop-up assembly by vandals, or others, and which when operated does not disturb the previous setting of the trip mechanism in the sprinkler.

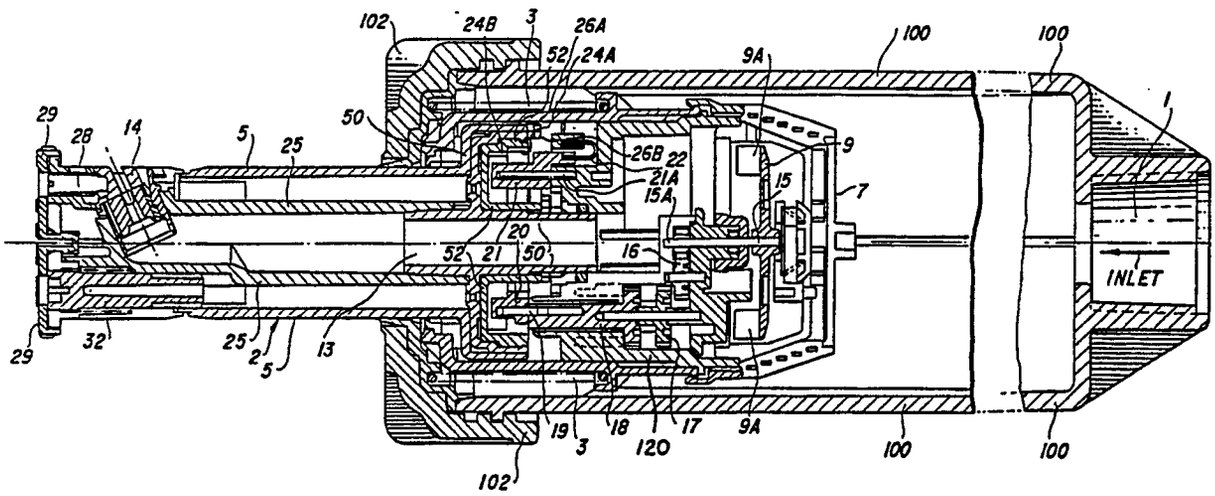

FIG. 1

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IRRIGATION SPRINKLER WITH AN INTERNAL DRIVE CLUTCH

The present invention relates to an improved irrigation sprinkler.

Sprinkler heads with rotatable pop-up nozzles propelled by water pressure are presently in widespread use. These heads are capable of discharging relatively large volumes of water over large areas. Many types of self-propelled rotatable sprinkler heads are known. One particular type of such irrigation sprinkler head, for example, is described in US Patent 4,650,118. The sprinkler head described in the patent includes a pop-up assembly which is caused to extend up through the cap of the housing against internal spring force by internal water pressure, and in which the extended pop-up assembly is driven by a water-powered motor. A nozzle mounted on the upper end of the pop-up assembly is turned back and forth through a preset arc in order to irrigate a sector of land of a particular size.

The sprinkler described in US Patent 4,650,118 is constructed so that when the pop-up assembly is turned to a particular angular position, a trip tab on the pop-up assembly engages a shifter, and it moves the shifter a small angular increment which in turn engages a pawl and causes the mechanism to reverse so that the pop-up assembly is rotated in the opposite direction to the other end of its preset arc, at which the procedure is repeated by a second trip tab.

The sprinkler head to be described in the present application is of the same general type as the sprinkler head of US Patent 4,650,118. However, it will become evident as the description proceeds that the present invention is not limited to that particular sprinkler head.

It is an object of the present invention to provide a clutch mechanism in the sprinkler head to protect the internal components of the sprinkler in the presence of forced rotation of the pop-up assembly by vandals or others.

It is a further object of the invention to provide such a clutch mechanism which, upon operation, does not disturb in any way the previously preset trigger mechanism of the sprinkler head.

The present invention provides a sprinkler head which comprises a tubular housing having an inlet at one end, an internal assembly mounted within the housing, a nozzle mounted on the end of the internal assembly for discharging water over a sector of land to be irrigated in response to water introduced under pressure into the housing through the inlet, the internal assembly including at least one tubular member rotatably mounted in the tubular housing in coaxial relationship therewith, characterised in that the sprinkler head further comprises a drive ring coaxially mounted with respect to the tubular member; means coupling the drive ring to the tubular member; and drive means mounted in the housing and engaging the drive ring to cause the tubular member to turn in the housing, the coupling means forming a drive clutch between the drive ring and the tubular member and responding to forceable rotation of the tubular member with respect to the housing to provide relative rotation between the tubular member and the drive ring so as to protect the internal assembly.

An embodiment of the sprinkler head according to the invention will now be described with reference to the accompanying drawings, in which

Figure 1 is a side section of a sprinkler head constructed to incorporate the clutch mechanism of the invention;

Figure 2 is a side section of the trip mechanism incorporated into the sprinkler head of Figure 1;

Figure 3 is a cross-section taken substantially along the line 3-3 of Figure 2; and

Figure 4 is a simplified schematic diagram of the clutch mechanism, which in accordance with the present invention, is incorporated into the sprinkler head of Figures 1 to 3.

The irrigation sprinkler assembly shown in Figure 1, for example, includes a tubular housing (100) having an inlet (1) at one end through which water under pressure is introduced into the interior of the housing. A pop-up assembly designated generally as 2 is coaxially mounted within the tubular housing for axial movement within the housing from a retracted position to an operational position (shown in Figure 1) in which the pop-up assembly protrudes through a central opening in a cap (102) mounted on the other end of housing (100). The pop-up assembly is spring-biased to its retracted position by a spring (3), and is forced into its illustrated operational position by water pressure introduced into the housing (100) through inlet (1). The pop-up assembly (2) includes an outer tubular riser (5) and a coaxial inner tubular riser assembly (25).

A water-driven motor including a rotor (9) is mounted on the inner end of the pop-up assembly. Water is introduced into the motor through a screen filter (7), and the water passes through the motor and through an internal axial passage (13) in the inner riser assembly (25) to a nozzle assembly (14) mounted on the upper end of the inner riser assembly. A cap (29) is mounted on the upper end of the inner riser assembly by a snap fit therewith.

Rotor (9) of the motor is coupled through a drive shaft (15) to a pinion (15A). Pinion (15A)

drives an idler gear (16) which, in turn, drives an output shaft (18) through a series of reduction gears (17) in a gear box (120). The rotor (9) has a series of rotor blades (9A) against which the incoming water pressure is directed and which cause the rotor to rotate. The output shaft drives an axial eccentric pin (19) which operates a pawl (20), shown in Figure 3.

Pawl (20), as shown in Figure 3 is engaged by an arcuate follower (21) which is pivotally mounted on a shaft (21A). An over-center spring (22) serves to turn the follower (21) in a first direction to force a projection (23A) at one end of pawl (20) into engagement with a first set of teeth (24A); or alternately to turn the pawl so that a tooth (23B) at its other end engages a second set of teeth (24B) which are positioned adjacent to teeth (24A). The teeth (24A) and (24B) are oppositely directed, so that when the pawl (20) engages teeth (23A) the pop-up assembly is caused to turn in one direction, and when the pawl engages the teeth (23B) the pop-up assembly is caused to turn in the opposite direction.

The teeth (24A) and (24B) are formed on the interior surface of a drive ring member (52) which is coupled to the inner riser assembly (25) through a coaxial tubular member (50). These elements form a protective clutch with the inner riser which will be described in more detail in conjunction with Figure 4.

The follower (21) is moved angularly between its first and second positions by a shifter (27) which is pivotally mounted on the inner end of the gear box (120) at a pivot point X. As best shown in Figure 2, the outer riser (5) has a trip tab (26A) protruding from its lower end, and the tubular member (50) attached to the inner riser assembly (25) has a trip tab (26B) protruding from its inner end. The shifter mechanism (27) has a pair of resilient fingers (27A) and (27B). Finger (27A) is engaged by tab (26A), for example, when the pop-up assembly reaches a particular limiting angular position; and resilient finger (27B) is engaged by trip tab (26B) when the pop-up assembly is turned to its other limiting position.

When the trip tabs engage the resilient fingers of the shifting mechanism, they cause the shifting mechanism to move from one position to another causing the follower (21) to actuate the over-center spring (22), and thereby moving the pawl assembly (20) from one position to another. The positions of the trip tabs (26A) and (26B) may be adjusted by controlling the relative angular positions of the inner riser assembly (25) and outer riser (5), and this is achieved by rotating screw (32) (Figure 1), as is described in more detail in our co-pending European Patent Application No. (USSN 339,203).

As described and claimed in our co-pending European Patent Application No. (USSN 335,694), the fingers (27A) and (27B) of the shifter (27) are resilient. When either trip tab (26A) or trip tab (26B) is forced against the corresponding resilient finger (27A) or (27B) of the shifter (27), instead of breaking off the trip tab, the corresponding resilient finger (27A) or (27B) is forced downwardly enabling the particular trip tab (26A), (26B) to pass over the resilient finger. Then, subsequent rotation by the internal motor (9) causes the internal mechanism again to reset itself to its original setting so that the sprinkler may continue to operate without damage.

As shown in Figures 3 and 4, the tubular insert (50) has ratchet serrations (50A) which engage corresponding ratchet teeth (52B) of ratchet beams (52A) of drive ring (52). The ratchet beams are formed by angularly spaced axial slots in the drive ring. Drive ring (52), accordingly, is coupled to the tubular insert (50), and hence to the inner riser assembly (25), by a ratchet mechanism which forms a drive clutch between the drive ring (52) and the inner riser assembly (25).

The purpose of the drive clutch mechanism is to protect pawl (20) (Figure 3) and/or drive ring (52) from damage due to forced rotation of the pop-up assembly by vandals, or others. Such forced rotation causes pawl (20) to attempt to drive the pop-up assembly (2) in the opposite direction to the direction of the forced rotation. Since the pawl (20) and drive ring (52) are usually formed of plastic, either or both of these components will be damaged by the forced rotation in the absence of the drive clutch.

The drive clutch protects the pawl and drive ring by creating a slip interface between the inner riser assembly (25) and drive ring (52) in the presence of forced rotation of the pawl assembly. Specifically, during normal operation the drive ring (52) drives the inner riser through the engagement of ratchet teeth (52B) and (50A). However, excessive counter-forces cause the ratchet beams (52A) of drive ring (52) to rise up over the ratchet teeth (50A) to produce relative movement between the drive ring and the pawl assembly thereby serving to protect the pawl and drive ring from damage.

It will be appreciated that the protective action of the slip clutch mechanism in no way affects the angular displacement of the trip tabs (26A), (26B) (Figures 1 to 3) so that the previous setting of the trip points of the sprinkler is undisturbed.

Claims

1. A sprinkler head which comprises a tubular housing (100) having an inlet (1) at one end, an internal assembly (2) mounted within the housing (100), a nozzle (14) mounted on the end of the

internal assembly (2) for discharging water over a sector of land to be irrigated in response to water introduced under pressure into the housing (100) through the inlet (1), the internal assembly (2) including at least one tubular member (25) rotatably mounted in the tubular housing (100) in coaxial relationship therewith, characterised in that the sprinkler head further comprises a drive ring (52) coaxially mounted with respect to the tubular member (25); means (50) coupling the drive ring (52) to the tubular member (25); and drive means (20) mounted in the housing (100) and engaging the drive ring (52) to cause the tubular member (25) to turn in the housing (100), the coupling means (50) forming a drive clutch between the drive ring (52) and the tubular member (25) and responding to forceable rotation of the tubular member (25) with respect to the housing (100) to provide relative rotation between the tubular member (25) and the drive ring (52) so as to protect the internal assembly (2).

2. A sprinkler head according to claim 1, characterised in that the coupling means (50) comprises a ratchet mechanism.

3. A sprinkler head according to claim 1 or claim 2, characterised in that the drive ring (52) has a plurality of angularly spaced axial slots forming resilient beams (52A) included in the coupling means (50).

4. A sprinkler head according to claim 3, characterised in that ratchet teeth (52B, 50A) are formed in the resilient beams (52A) and in the tubular member (50) which engage one another to form the coupling means, and which rise up over one another in response to forceable rotation.

5. A sprinkler head according to any of claims 1 to 4, characterised in that the drive ring (52) has a plurality of drive teeth (24A, 24B) formed therein, and the drive means includes a pawl (20).

6. A sprinkler head according to claim 5, characterised in that the internal assembly (2) includes inner (25) and outer (5) tubular risers slidably and rotatably mounted in the tubular housing (100) in coaxial relationship therewith and with one another, and in which the drive ring (52) extends coaxially into the inner riser (25) and is affixed thereto.

7. A sprinkler head according to claim 6, characterised in that the drive ring (52) has first and second pluralities of drive teeth (24A, 24B) formed therein, and the pawl (20) is movable between first and second angular positions selectively to engage one or the other of the pluralities of drive teeth (24A, 24B) to cause the internal assembly (2) to turn in one direction or the other in the housing (100).

8. A sprinkler head according to claim 7, characterised in that it comprises a reversing mechanism (21) mounted in the housing and movable between first and second positions to cause the pawl (20) to engage one or the other of said pluralities of drive teeth (24A, 24B), a first trip tab (26B) coupled to the inner riser (25) for moving the reversing mechanism (21) to its first position, and a second trip tab (26A) coupled to the outer riser (5) for moving the reversing mechanism (21) to its second position, trip tabs (26A, 26B) serving to reverse the direction of rotation of the nozzle assembly (14) at angular positions determined by the relative angular displacement of the trip tabs (26A, 26B).

9. A sprinkler head according to claim 1, characterised in that the internal assembly (2) comprises a pop-up assembly (2) which extends out of the tubular housing (100) when water pressure is applied through the inlet (1) and which retracts back into the tubular housing (100) when water pressure is relieved.

10. A sprinkler head according to claim 9, characterised in that the internal assembly (2) rotates as a single member when driven by the drive means (24A, 24B) and is extended out from the tubular housing (100).

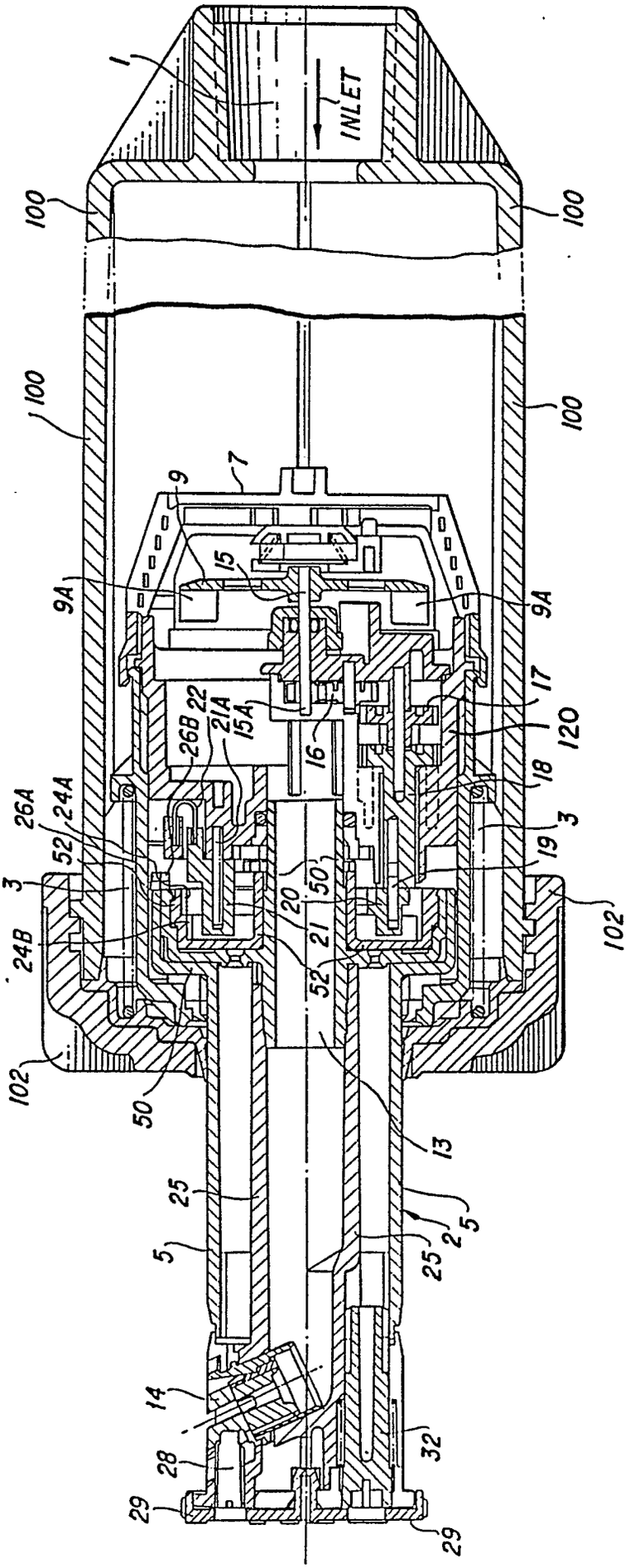

INLET
1
100
7
9
15
9A
17
120
18
16
15A
21A
22
26B
26A
24A
52
3
19
20
50
21
24B
102
13
25
5
14
28
29
32

FIG. 1

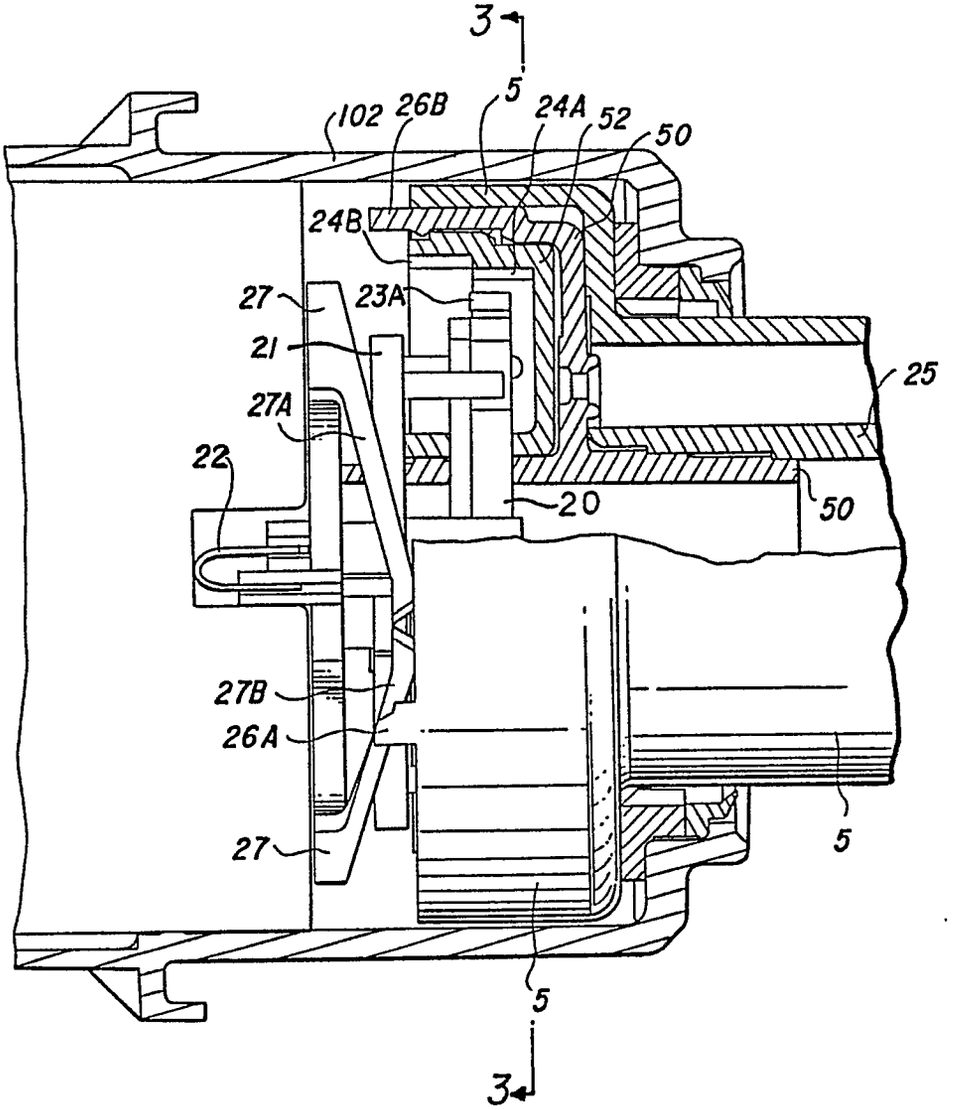
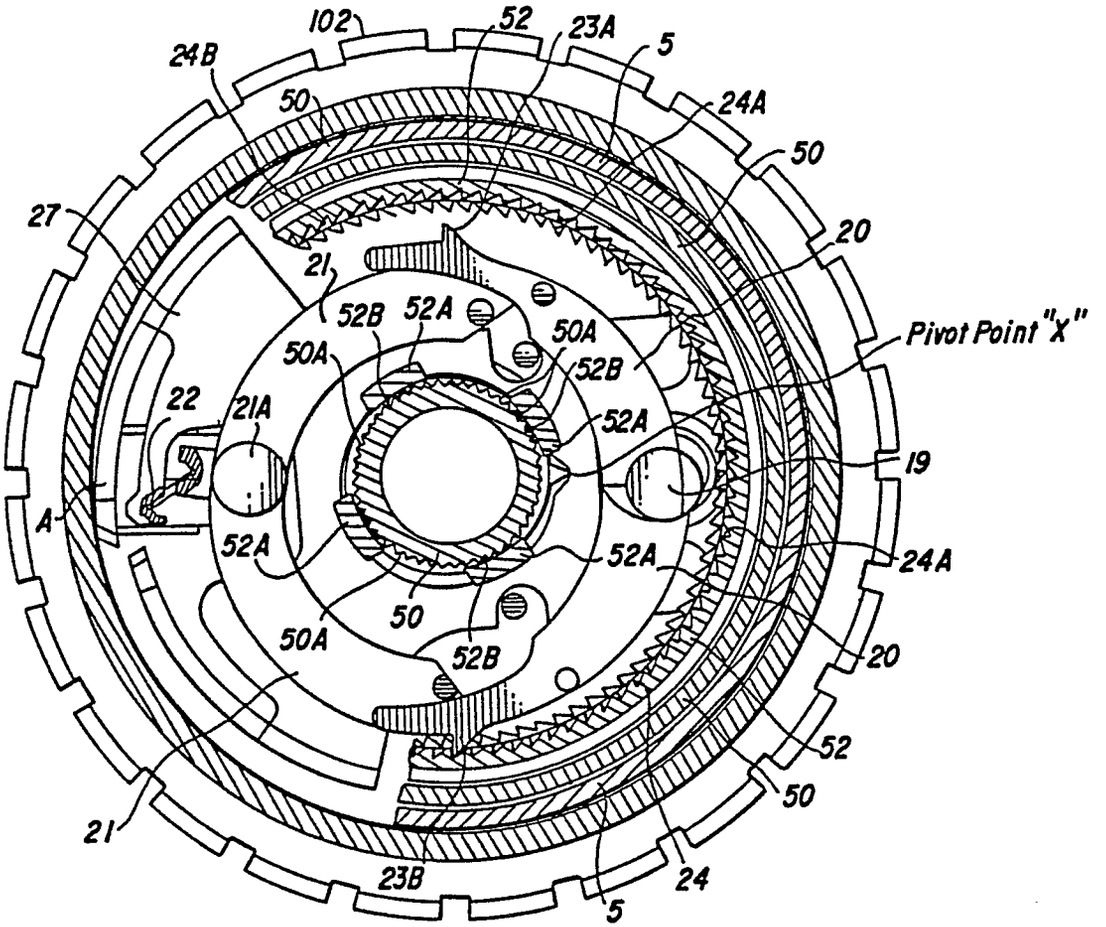


FIG. 2

FIG. 3


102
52
23A
5
24B
50
24A
50
27
20
21
52B
52A
50A
Pivot Point "X"
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52B
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52B
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52
21
50
23B
24
5

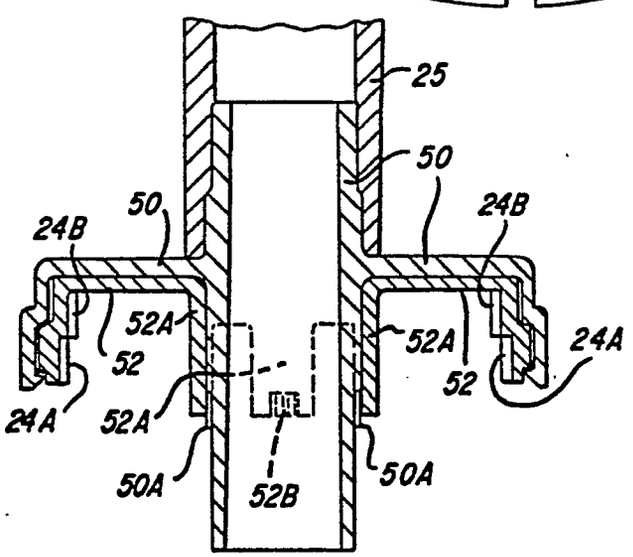
25
50
50
24B
24B
52A
52
52A
52
24A
24A
52A
50A
52B
50A

FIG. 4